

LAWRENCE LIVERMORE REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Jan. 10-14, 2011

Looking for more CO₂



Denbury Resources began pumping carbon dioxide into this oil field in Alvin, Texas, last month. The gas is piped in from Mississippi and helps extract oil. Photo by Wenjing Zhang for *The Texas Tribune*.

While the Obama administration views carbon dioxide as a pollutant and is looking for ways to curb CO₂ emissions, Texas oil companies are looking for more of it.

In Texas, the nation's largest oil-producing state, the demand for CO₂ is soaring because carbon dioxide can help squeeze oil out of formations deep underground. Projects already are under way at power plants to capture the CO₂ before it is emitted into the atmosphere and buried deep underground.

One pilot project, slated to expand, has been operating in West Virginia since 2009, and another plant that may capture and store carbon dioxide is under construction in Indiana. In addition to the two proposed Texas plants, projects are in the planning phases in California, Illinois, Kentucky and Mississippi, said Julio Friedmann, director of the Laboratory's carbon management program.

To read more, go to the [Web](#).

Killing two birds with one stone



Photo courtesy of NOAA

Using seawater and calcium to remove CO₂ at its source in a natural gas power plant's flue stream and then pumping the resulting calcium biocarbonate in the sea could be beneficial to the oceans' marine life.

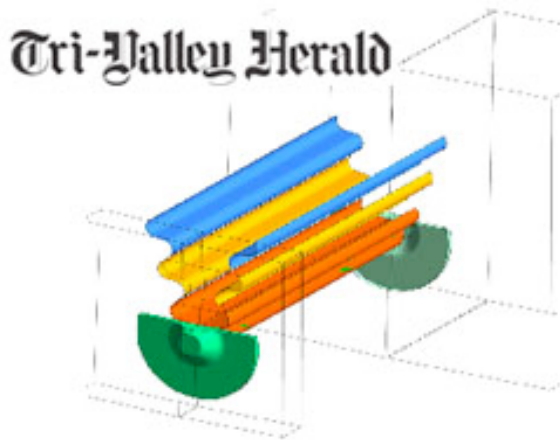
Greg Rau, a Laboratory scientist who also works at UC Santa Cruz' Institute of Marine Sciences, conducted a series of lab-scale experiments to find out if a seawater/mineral carbonate (limestone) gas scrubber would remove enough CO₂ to be effective, and whether the resulting substance – dissolved calcium biocarbonate – could then be placed in the ocean to help neutralize it. In effect, killing two birds with one stone.

Whether carbon dioxide is released in the atmosphere or the ocean, eventually about 80 percent of the carbon dioxide will end up in the ocean in a form that will make the ocean more acidic. While the carbon dioxide is in the atmosphere, it could produce adverse climate change. When it enters the ocean, the acidification could be harmful to marine life, especially corals and shellfish.

In his experiments, Rau found that the scrubber removed up to 97 percent of CO₂ in a simulated flue gas stream, with a large fraction of the carbon ultimately converted to dissolved calcium bicarbonate.

To read more, go to the [Web](#).

An algorithmic trek



The decades-old approach to teaching math in U.S. high schools doesn't add up when it comes to the technology in use today -- applications such as Google earth, 3D animation, GPS and robotics.

How can students be up to date developing the skill-sets needed for mathematical problem-solving in the 21st century? A new algorithmic geometry class at San Ramon's Dougherty Valley High School might just help students gain those skill-sets.

Partnering with a local courseware developer and a public high school, Lawrence Livermore National Security, LLC (LLNS), the contract manager for the Laboratory, contributed \$10,000 toward this one-of-a-kind pilot course in algorithmic geometry. The course is geared toward juniors and seniors with strong math skills and an interest in high-tech careers.

Unlike traditional methods of teaching math where students are instructed to solve arbitrary math equations with little context or connection to applications, algorithmic geometry immerses students in "real world" challenges requiring creative application of math skills to find a solution -- for example, designing a computer algorithm to control a robotic arm.

The paradigm change does not stop there. In 21st century applications, math know-how is brought to life by writing software.

To read more, go to the [Web](#).

Poison as a building block? Say it isn't so.

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LLNL's Jennifer Pett-Ridge, right, runs the NanoSIMS and analyzes some arsenic-grown cells from Mono Lake as NASA/USGS's Felisa Wolfe-Simon observes.

Laboratory scientists working with NASA and the U.S. Geological Survey have found that arsenic -- an element that triggers death for most earthly life forms -- is actually allowing for bacterium to thrive and reproduce.

The team found the first known living organism, isolated from Mono Lake, that can use arsenic in place of phosphorus in its major macromolecules. The new findings could redefine research into origins of life and alter the way we describe life as we know it.

Oxygen, carbon, hydrogen, nitrogen, sulfur and phosphorous are the six basic building blocks of life on Earth. These elements make up nucleic acids, proteins and lipids -- the bulk of living matter.

Lab scientists were able to identify low concentrations of arsenic found in individual cells of bacteria and extracted DNA using NanoSIMS, a tool which allows precise, spatially explicit, elemental and isotopic analysis down to the 50-nanometer scale.

To read more, go to the [Web](#).

LLNL Kennedy Reed honored by science society



Laboratory physicist Kennedy Reed has been awarded the distinction of fellow of the American Association for the Advancement of Science (AAAS). He is being recognized for important studies in atomic theory, and for many successful efforts to increase minority participation in the physical sciences in the United States and Africa.

Election as a fellow is an honor bestowed upon AAAS members by their peers to recognize distinguished efforts to advance science or its applications. This year, 503 members have been awarded this honor by AAAS because of their scientifically or socially distinguished efforts to advance science or its applications.

Reed has produced more than 100 publications on his research in atomic collisions in high-temperature plasmas, and his work has contributed to the understanding of indirect processes in electron-impact excitation and ionization of highly charged ions.

He is a prominent leader in national efforts to increase opportunities for minority students and professionals in the sciences, and has helped develop and direct programs that have expanded research and training capabilities at minority serving institutions and enabled students to pursue advanced degrees in physical science disciplines.

To read more, go to the [Web](#).

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research

institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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